

CLAIMS

What is claimed is:

1. A power transmission device comprising:

a rotary input member adapted to receive drive torque from a source of torque;

a rotary output member adapted to provide drive torque to an output device; and

a torque transfer mechanism operable for transferring drive torque from said input member to said output member, said torque transfer mechanism including a bi-directional overrunning clutch having a first ring non-rotatably coupled to one of said rotary input member and said rotary output member, a second ring spaced apart from the other of said rotary input member and said rotary output member and rollers disposed in aligned cam tracks formed in facing surfaces of said first and second rings, said second ring adapted to circumferentially index relative to said first ring to cause said rollers to ride up said cam tracks and cause said second ring to frictionally engage the other of said rotary input member and said rotary output member.

2. The power transmission device of claim 1 wherein said rotary input member includes a substantially cylindrical bore, and wherein said first ring has an outer surface engaging said bore and an inner surface on which said cam tracks are formed.

3. The power transmission device of claim 2 wherein said first ring includes a thickness between its outer surface and its inner surface, and wherein said thickness is varied to account for varied spacing between said bore and said rotary output member.

4. The power transmission device of claim 3 wherein said rotary input member includes an annular lip inwardly protruding from said bore, and wherein said first ring includes an end face engaging said lip.

5. The power transmission device of claim 1 wherein said second ring is a split ring defining an actuation slot having first and second edge surfaces, said power transmission device further including an actuator ring having a lug retained in said actuation slot of said split ring and which is moveable from a central position disengaged from said first and second edge surfaces in a first direction into engagement with said first edge surface and in a second direction into engagement with said second edge surface.

6. The power transmission device of claim 5 wherein said actuator ring has a rim on which a drag band is retained, said drag band having a pair of ends between which a cam member is retained, said cam member having a first segment operable to cause said drag band to exert a drag force on said rim of said actuation ring which causes circumferential indexing of said actuator ring in response to relative rotation between said first and second rings, said cam member further including a second segment operable to release said drag force from said actuation ring.

7. A power transmission device comprising:

a rotary input member adapted to receive drive torque from a source of torque;

a rotary output member adapted to provide drive torque to an output device; and

a torque transfer mechanism operable for transferring drive torque from said input member to said output member, said torque transfer mechanism including a bi-directional overrunning mode clutch having a first ring driven by said rotary input member, a second ring non-rotatably coupled to said first ring, a third ring positioned on said rotary output member and rollers disposed in aligned cam tracks formed in facing surfaces of said second and third rings, said third ring adapted to circumferentially index relative to said second ring to cause said rollers to ride up said cam tracks and cause said third ring to frictionally engage said rotary output member, and a mode actuator that is moveable between a first position and a second position to establish corresponding AUTO and LOCK modes, said overrunning clutch being operable in its AUTO mode to permit relative rotation between said rotary input member and said rotary output member in a first direction and prevent relative rotation therebetween in a second direction, and said overrunning clutch being operable in its LOCK mode to prevent relative rotation between said rotary input member and said rotary output member in both directions.

8. The power transmission device of claim 7 wherein said first ring includes a substantially cylindrical bore, and wherein said second ring has an outer surface engaging said bore and an inner surface on which said cam tracks are formed.

9. The power transmission device of claim 8 wherein said second ring has a thickness defined between its inner and outer surfaces and wherein said thickness is varied to account for varied spacing between said bore and said rotary output member.

10. The power transmission device of claim 9 wherein said first ring includes an annular lip protruding from said bore and said second ring includes an end surface engaging said lip.

11. The power transmission device of claim 7 wherein said third ring includes an actuation slot having first and second edge surfaces, and wherein said mode actuator is an actuator ring having a lug retained in said actuation slot of said third ring and which is moveable from a central position disengaged from said first and second edge surfaces in a first direction into engagement with said first edge surface and in a second direction into engagement with said second edge surface.

12. The power transmission device of claim 11 wherein said actuator ring has a rim on which a drag band is retained, said drag band having a pair of ends between which a cam member is retained, said cam member having a first segment operable to cause said drag band to exert a drag force on said rim of said actuation ring which causes circumferential indexing of said actuator ring in response to relative rotation between said second and third rings, said cam member further including a second segment operable to release said drag force from said actuation ring.

13. A power transmission device comprising:

- a rotary input member adapted to receive drive torque from a source of torque;
- a rotary output member adapted to provide drive torque to an output device; and
- a bi-directional overrunning clutch operable for transferring drive torque from said input member to said output member, said bi-directional overrunning clutch including a first ring driven by said rotary output member, a second ring non-rotatably coupled to said rotary input member, a third ring positioned between said first ring and said second ring and rollers disposed in aligned cam tracks formed in facing surfaces of said second and third rings, said third ring adapted to circumferentially index relative to said second ring to cause said rollers to ride up said cam tracks and cause said third ring to frictionally engage said first ring.

14. The power transmission device of claim 13 further including an actuator for controlling rotational movement of said third ring relative to said second ring.

15. The power transmission device of claim 14 wherein the actuator is moveable between a first position and a second position to establish corresponding AUTO and LOCK modes, said power transmission device being operable in its AUTO mode to permit relative rotation between said rotary input member and said rotary output member in a first direction and prevent relative rotation therebetween in a second direction, and said power transmission device being operable in its LOCK mode to prevent relative rotation between said rotary input member and said rotary output member in both directions.

16. The power transmission device of claim 15 wherein said power transmission device is a transfer case with said rotary input member being a first output shaft and said rotary output member being a second output shaft.

17. A power transmission coupling comprising:

a first coupling member including a first friction surface;

a second coupling member including a first cylindrical bearing surface;

a third coupling member including a second cylindrical bearing surface and a third cylindrical bearing surface, said third bearing surface including a plurality of first recesses;

a tubular slipper positioned between said first and third coupling members, said tubular slipper including a second friction surface for engagement with said first friction surface, and a fourth cylindrical bearing surface including a plurality of second recesses, each of said first recesses together with their respective one of said second recesses defining a pocket;

a plurality of roller elements disposed in said pockets for coupling said first coupling member to said second coupling member when said tubular slipper and said third coupling member rotate relative to one another; and

an actuator for controlling rotational movement of said tubular slipper relative to said third coupling member.

18. The power transmission coupling of claim 17 wherein the actuator is moveable between a first position and a second position to establish corresponding AUTO and LOCK modes, said power transmission device being operable in its AUTO mode to permit relative rotation between said first coupling member and said third coupling member in a first direction and prevent relative rotation therebetween in a second direction, and said power transmission device being operable in its LOCK mode to prevent relative rotation between said first coupling member and said third coupling member in both directions.

19. The power transmission coupling of claim 18 wherein each of said first, second, third and fourth cylindrical bearing surfaces are substantially coaxially aligned.

20. The power transmission coupling of claim 17 wherein the power transmission coupling is located within a transfer case.

21. The power transmission coupling of claim 17 wherein said tubular slipper is a split ring defining an actuation slot having first and second edge surfaces, said actuator including an actuator ring having a lug retained in said actuation slot of said split ring and which is moveable from a central position disengaged from said first and second edge surfaces in a first direction into engagement with said first edge surface and in a second direction into engagement with said second edge surface.

22. The power transmission coupling of claim 17 wherein said first coupling member is selected from the group consisting of a rotary shaft and a sprocket.

23. A method of making a power transmission device comprising:
determining a distance between a first bearing surface of a first coupling member and a first friction surface of a second coupling member;
selecting a third coupling member from a group of coupling members having different thicknesses, said selection being based on said distance, said third coupling member including a second bearing surface and a third bearing surface;
engaging said first bearing surface with said second bearing surface to non-rotatably couple said third coupling member to said first coupling member;
positioning a plurality of rollers between said third coupling member and a tubular slipper, said tubular slipper having a second friction surface and a fourth bearing surface, said third and fourth bearing surfaces having cam tracks formed thereon to receive said plurality of rollers; and
positioning said second friction surface spaced apart from said first friction surface to allow selective coupling of said first coupling member and said second coupling member by rotating said tubular slipper relative to said third coupling member.

24. The method of claim 23 further including coaxially aligning cylinders defined by each of said first bearing surface, said second bearing surface, said third bearing surface, said fourth bearing surface, said first friction surface and said second friction surface.

25. The method of claim 23 wherein said first coupling member is a sprocket having teeth engaging a power transfer element.

26. The method of claim 23 wherein said first coupling member is a rotary shaft.

27. The method of claim 23 further including engaging an edge of said third coupling member with a lip radially inwardly extending from said first coupling member.

28. A transfer case for transferring drive torque from a powertrain to first and second drivelines of a motor vehicle, said transfer case comprising:

- a first shaft adapted to transfer drive torque from the powertrain to the first driveline;

- a second shaft adapted for connection to the second driveline;

- a transfer assembly including a first sprocket driven by said first shaft, a second sprocket surrounding said second shaft, and a drive mechanism interconnecting said second sprocket to said first sprocket; and

- a mode clutch for selectively coupling said second shaft for rotation with said second sprocket, said mode clutch including a first ring having an outer surface engaging an inner surface of said second sprocket and an inner surface with first cam surfaces, a second ring having an inner surface mounted on an outer surface of said second shaft and an outer surface with second cam surfaces, and rollers disposed between aligned sets of said first and second cam surfaces, said second ring adapted to circumferentially index relative to said first ring to cause said rollers to ride up said cam surfaces and cause said inner surface of said second ring to frictionally engage said outer surface of said second shaft.

29. The transfer case of Claim 28 further comprising:

an actuator that is moveable between first and second positions to establish corresponding AUTO and LOCK modes for said mode clutch, said mode clutch is operable in its AUTO mode to permit relative rotation between said first and second shafts in a first direction and prevent relative rotation therebetween in a second direction, and said mode clutch is operable in its LOCK mode to prevent relative rotation between said first and second shafts in both directions; and

a shift mechanism for moving said actuator between its first and second positions.

30. A transfer case for transferring drive torque from a powertrain to first and second drivelines of a motor vehicle, said transfer case comprising:

a first shaft adapted to transfer drive torque from the powertrain to the first driveline;

a second shaft adapted for connection to the second driveline;

a transfer assembly including a first sprocket surrounding said first shaft, a second sprocket fixed to said second shaft, and a drive mechanism interconnecting said first sprocket to said second sprocket; and

a mode clutch for selectively coupling said first sprocket for rotation with said first shaft, said mode clutch including a first ring having an outer surface engaging an inner surface of said first sprocket and an inner surface with first cam surfaces, a second ring having an inner surface mounted on an outer surface of said first shaft and an outer surface with second cam surfaces, and rollers disposed between aligned sets of said first and second cam surfaces, said second ring adapted to circumferentially index relative to said first ring to cause said rollers to ride up said cam surfaces and cause said inner surface of said second ring to frictionally engage said outer surface of said first shaft.

31. The transfer case of Claim 30 further comprising:

an actuator that is moveable between first and second positions to establish corresponding AUTO and LOCK modes for said mode clutch, said mode clutch is operable in its AUTO mode to permit relative rotation between said first and second shafts in a first direction and prevent relative rotation therebetween in a second direction, and said mode clutch is operable in its LOCK mode to prevent relative rotation between said first and second shafts in both directions; and

a shift mechanism for moving said actuator between its first and second positions.

32. A transfer case for transferring drive torque from a powertrain to first and second drivelines of a motor vehicle, said transfer case comprising:

a first shaft adapted to transfer drive torque from the powertrain to the first driveline;

a second shaft adapted for connection to the second driveline;

a transfer assembly including a first sprocket driven by said first shaft, a second sprocket surrounding said second shaft, and a drive mechanism interconnecting said second sprocket to said first sprocket; and

a mode clutch for selectively coupling said second shaft for rotation with said second sprocket, said mode clutch including a first ring having an outer surface engageable with an inner surface of said second sprocket and an inner surface with first cam surfaces, a second ring having an inner surface secured to an outer surface of said second output shaft and an outer surface with second cam surfaces, and rollers disposed between aligned sets of said first and second cam surfaces, said first ring adapted to circumferentially index relative to said second ring to cause said rollers to ride up said cam surfaces and cause said outer surface of said first ring to frictionally engage said inner surface of said second sprocket.

33. The transfer case of Claim 32 further comprising:

an actuator that is moveable between first and second positions to establish corresponding AUTO and LOCK modes for said mode clutch, said mode clutch is operable in its AUTO mode to permit relative rotation between said first and second shafts in a first direction and prevent relative rotation therebetween in a second direction; and said mode clutch is operable in its LOCK mode to prevent relative rotation between said first and second shafts in both directions; and

a shift mechanism for moving said actuator between its first and second positions.

34. A transfer case for transferring drive torque from a powertrain to first and second drivelines of a motor vehicle, said transfer case comprising:

- a first shaft adapted to transfer drive torque from the powertrain to the first driveline;

- a second shaft adapted for connection to the second driveline;

- a transfer assembly including a first sprocket surrounding said first shaft, a second sprocket fixed to said second shaft, and a drive mechanism interconnecting said second sprocket to said first sprocket; and

- a mode clutch for selectively coupling said first sprocket for rotation with said first shaft, said mode clutch including a first ring having an outer surface engageable with an inner surface of said first second sprocket and an inner surface with first cam surfaces, a second ring having an inner surface secured to an outer surface of said second output shaft and an outer surface having second cam surfaces, and rollers disposed between aligned sets of said first and second cam surfaces, said first ring adapted to circumferentially index relative to said second ring to cause said rollers to ride up said cam surfaces and cause said outer surface of said first ring to frictionally engage said inner surface of said first sprocket.

35. The transfer case of Claim 34 further comprising:

an actuator that is moveable between first and second positions to establish corresponding AUTO and LOCK modes for said mode clutch, said mode clutch is operable in its AUTO mode to permit relative rotation between said first and second shafts in a first direction and prevent relative rotation therebetween in a second direction, and said mode clutch is operable in its LOCK mode to prevent relative rotation between said first and second shafts in both directions; and

a shift mechanism for moving said actuator between its first and second positions.